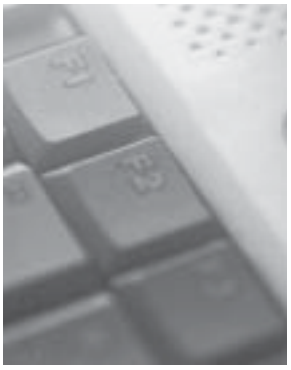

Case Studies of Future Teachers: Learning to Teach with Technology

Melissa E. Pierson and Alysa Cozart

Abstract

This longitudinal research study explores preservice teachers' developing vision of technology in teaching and learning. Participants include eight teacher education students enrolled in one of three consecutive educational technology courses. Qualitative methods were used to analyze data, and tentative assertions have emerged related to a developing vision of teaching with technology: expectations for teaching with technology, perceived challenges of technology, questioning classroom uses of technology, and the driving development of a technology-rich program by education students.

Rather than having to change teachers' beliefs about technology from developed visions of teaching that do not include technology (Russell, Bebell, O'Dwyer, & O'Connor, 2003), early intervention in the developing of the teaching vision should embed in it the importance of meaningful technology use. New models of introducing technology to prospective teachers, along with assessment strategies and authentic technology uses, have been proposed and explored, all aimed at providing rich environments in which prospective teachers can learn to effectively use technology for teaching and learning. In this work, a facet of the preservice teaching experience that has begun to be unveiled involves future teachers' understanding of their own roles as teachers. As they gain experience over time, preservice teachers develop a deeper understanding of their professional identities, which emerge as they begin to think about their beliefs and images of teaching (Mullen, 2001). The abstract teaching image holds the power to define teaching for the individual by serving as the filter through which new experiences and knowledge pass and subsequently interact with the realities of classroom life (Mahlios, 2002).

Indeed, these images of self-as-teacher have a lasting impact on the influence of computer technologies in the classroom. There exists substantial evidence to suggest that teachers' beliefs in their capacity to work effectively with technology, or their self-efficacy for technology integration, shape later computer use (Wang, Ertmer, & Newby, 2004).

The present study is longitudinal in nature with the intent of clarifying the role technology plays in the development of prospective teachers from initial teacher education experiences through the induction years. An initial set of research questions has guided this work:

1. Do these novice teachers see technology as integrated with the teaching knowledge and skills they are learning?
2. Do technology-use strategies develop simultaneously with or independently from pedagogical practice and understanding?
3. Do novice teachers consider technology tools when planning for teaching?
4. How do these attitudes, understandings, and skills change and mature over time, throughout the teacher preparation program, and into the induction years of teaching?

The authors describe here the research design and perspective, and report on the first year of this longitudinal study according to some broad assertions aimed at understanding, from the participants' perspectives, their developing visions of technology in teaching and learning.

Participants

All students enrolled in the first course of a three-course educational technology series in Spring 2003 were introduced to the study and its goals early in the semester and were asked to participate. Seven students volunteered in the first semester and an additional participant joined the study during the second semester. Participants agreed to contribute to the study for four years, including the two years of teacher preparation courses followed by the first two induction years. A new cohort of participants will be enlisted in Fall 2004 so that ongoing research will chronicle the effect of research on instruction.

This group of volunteer participants represents remarkable diversity in career stages (traditional college-age students to second-career students), technology skills (few skills at the outset of the project to those with a wider range of skills), teaching goals (early childhood through middle school), and a rich collage of personal motivations for pursuing a teaching career.

Data Sources and Analysis

The primary data were recorded as interview field notes for the first two semesters of the study. Two individual interviews were conducted with each participant, one per semester for the first two semesters of the longitudinal project. Interviews lasted between 45 and 75 minutes, were held in the first author's office, and were semi-structured, guided by an interview protocol but allowing for redirection according to the participants' inclination to share information and ask questions. For participant convenience, later interviews may be held at their schools sites or over the telephone if students relocate away from the immediate area.

With the intention of getting into the minds of these future teachers to capture evidence on the role technology plays in their formative planning thoughts, participants completed a "Think-Aloud" activity each semester that required each student to audio-record her thoughts on planning a lesson. Unfortunately, these students were not yet required to teach enough lessons independently during their campus-based prepraration courses to have to confront planning issues of technology use. Although interesting in other ways, their recordings consisted of forced dialogue rather than the authentic planning reflections in action that were intended. By mutual agreement, researchers and participants decided to discontinue these recordings. The final form of data was derived from analyzing a variety of documents, most notably teaching-related work samples stored on Web-based portfolios, and Web-based

discussion transcripts. We anticipate that the range of documents of interest to the project will expand along with the participants' experience and teaching responsibilities.

The data collected have been analyzed qualitatively by coding transcripts and field notes through a process of repeated readings. We attempted to understand the meaning of the data in context by connecting interesting ideas into broad themes that then were translated into assertions about meaning in the teaching preparation for these eight students (Maxwell, 1996). Most written pieces, from interview write-ups to manuscripts, have been shared with participants as member checks to ensure that the writing reflects participants' intended meanings.

We have taken an action research stance toward this research so that the telling of others' stories is richer, more accurate, and ultimately more meaningful because the "others" have a role in the telling. Using an action research perspective based on the concepts of Listen-Think-Act has allowed our participants to play a role in the direction of research activities (Stringer, 1999). In fact, the research design has already been modified in some ways to be responsive to the needs of the participants. In the first two semesters, participants were involved to the extent that they reviewed interview transcripts, but we sensed that participants might have more to say that was not being captured within that early design. During an informal focus group lunch, some participants mentioned that they were not always able to remember important technology-related annecdotes when they were actually sitting down for the interview. Through continued discussion, the group hatched a plan to use a Web-based discussion board to post project-related ideas and thoughts, and potentially as a means of soliciting help from one another. Already, the group was beginning to conceptualize ways in which the collective whole might become a support for the individuals.

Participants have now augmented their abilities to record their teaching thoughts and behaviors otherwise not available to researchers and other group members by using handheld computers and digital cameras. Already, two participants have hosted an online discussion among their educational technology course peers comparing classroom computer labs, using their digital cameras to share images of various classrooms they have seen as a focus for the discussion.

Discussion of Emerging Assertions

Although a number of our typical college-aged students have grown up with computers as a normal part of their lives, they have not yet considered what an effective technology-rich classroom looks like (Russell et al., 2003). Their incomplete visions of the classroom must be combined with explicit actions on the part of instructors to model technology-rich strategies so that these future teachers can begin to imagine themselves teaching in such contexts. We have been able to trace some emerging trends in our data that help us explain the developing vision of what it means for these eight future teachers to teach with technology.

Expectations for Teaching with Technology

Novice teachers begin their teaching careers with a narrow view of technology, but with experience expand their vision of activities they might use to support their own students' learning (Beyerbach, Walsh, & Vannatta, 2001). Initially, the ways in which our participants imagined using technology were based on their own skill levels and experience; the more and varied the technology experience, the more and varied the uses they could imagine. Word processing, electronic presentations, and e-mail were common technology uses that participants for whom our first technology course was one of the first times they had focused specifically on using computers imagined as part of a learning environment. More technology-savvy participants spoke of using peripherals, such as scanners and digital cameras, and advanced software features.

A semester into the study, participants became more confident in their abilities to propose ways to use technology. One student responded when asked how she now imagined using technology, "I now know what it can do. OK, it's endless!" and another: "I could see myself actually using it." A third took the initiative to recommend some technology integration ideas to her mentor teacher, even though the vision was not complete in terms of how it might be implemented:

> [My mentor teacher] showed me her lesson plan. I went home and made my own lesson plan that had technology. She was good; she talked me through it, saying, "How did you think you might implement this?" I didn't know!

Research tells us that preservice teachers must see the technology modeled by university faculty, and they must be offered instruction and practice in integrating technology into their instructional methods (Pope, Hare, & Howard, 2002). The visions of at least five of these future teachers were beginning to expand to include some nuggets of pedagogical considerations for technology use. Several, such as this student, displayed a budding awareness of age-appropriateness in their instructional choices: "I keep having to remind myself that I'm dealing with fourth grade and to use graphics that are interesting to a fourth grader." This student made a conscious effort to address diverse learning styles, unprompted by the assignment requirements: "I've covered visual, covered hearing, and I covered pretty much all the aspects of every learning types of children so that anybody in my kindergarten class could understand it and participate in there."

These visions were strongly associated with what each individual knew about technology; the clear implication for teacher educators is to consider this developing vision of technology integration as they design learning activities for novice teachers. Providing ample opportunities to experience a wide variety of educational technologies for teaching, along with multiple examples of technology integration as a part of methods courses, will strengthen attitudes toward beliefs about the benefits of using technology (Abbott & Faris, 2001; Russell et al., 2003). A perfunctory focus in teacher preparation programs on using technology for limited or low-level learning goals could directly translate into limited visions of teaching with technology.

Perceived Challenges of Teaching with Technology

Without exception, participants in this study expect to use technology in their future classrooms and can describe ways that they envision using it. This is consistent with expectations of preservice teachers elsewhere (Balli, Wright, & Foster, 1997; Marcinkiewicz & Wittman, 1995; Mowrer-Popiel, Pollard, & Pollard, 1992). Already in their early development as teachers, our participants are aware that teaching with technology presents some unique challenges: troubleshooting, safety and supervision issues, and equity of resources are their concerns that echo barriers commonly cited in the literature, including lack of time for professional development (Keiper, Harwood, & Larson, 2000), lack of hardware and software, technology reliability, lack of institutional support, and uncertainty about its worth (Butler & Sellbom, 2002).

Interestingly, when asked about the challenges they expect to face in their future classrooms, the challenges the students highlighted during the first semester of the project-when in their first semester of teacher education courses-are different than those they mentioned during the second semester, after having taken one technology course as well as other teacher preparation courses. For one student, her anticipated concerns during the first interview focused on "getting [the technology] to work."

> I'm scared to put in a disk and have it not work. It's not like a piece of paper. You're scared that it will not work. I don't know how to troubleshoot if I have problems . . . I need someone to come in to assist me.

By the next semester, with some educational technology instruction under her belt and with the impending reality of teaching, her concerns understandably shifted to having enough time: "When am I going to have my weekends, my nights? I can see where it will take a lot of time the first two years."

Similarly, the concerns of another participant shifted with a semester's growth. During the first interview, she cited as a barrier to regular use knowing how to not misuse technology and how to ensure equitable use by all students. By the second semester, she first noted that it was "easier than I originally thought," but then provided more details on her thinking:

> In getting closer to having my own classroom, [I'm concerned with] being responsible for the TEKS (state standards). I dream about the TEKS! I'm trying to work out a system to manage them. I'm going to have a spreadsheet of the TEKS, to make sure I'm covering them. I'll organize them in Excel, and sort which have been covered, and check them off.

In this case, experience may have been working against her creativity and optimism, but rather than becoming completely overwhelmed by a state-demanded emphasis on standards, she explored the ways in which technology could be used to manage the standards responsibility.

It appeared that those fears early on reflected personal fears about technology use, along with inexperienced perceptions of what they should be concerned about (e.g., safety). As these novice educators became more informed about the teaching profession and its expectations, the challenges they expected to see became more focused on the reality of student needs and teacher limits. Clearly perceived barriers of technology use were present, and removing these barriers, even if possible, would not ensure meaningful technology use (Ertmer, 1999). However, it is our hope that with focused experiences our preservice teachers will be sufficient in their capacities to accommodate less-than-ideal conditions in order to work effectively with technology.

Questioning Classroom Uses of Technology

Preservice teachers recognize that participating in technology projects not only raises their awareness of technology as a process, but also expands their insights into their own learning experiences (McRobbie, Ginns, &, Stein, 2000). For novice teachers immersed for the first time in the profession, our participants not only became quite aware of the physical presence of technology in the classrooms they were observing, but they also were unexpectedly questioning of their cooperating teachers' efforts to use technology. Of those students with at least some classroom experience, through either substitute teaching or initial field-based experiences, most could depict the amount and, in general, the types of technologies they had seen in classrooms.

In addition to descriptions of physical machines, most were surprisingly critical of the ways in which teachers used technology:

> "I've seen some technology in schools, but not as much as I'd like."
>
> "I didn't see any computers. I thought that was sad."
>
> "The mini-lab is new, and I have a feeling [the computers] are not used."
>
> "She had one computer and used it only for taking attendance. . . . It's like they were just there as a prop, just sitting on a cart."
>
> "Teachers are so stuck on the overhead. It gets boring."
>
> "I think a lot of teachers are scared of it. Mainly they don't open their minds."

Reactions that shocked us at first later made sense when we considered the timing. As participants were enrolled in the sheltered context of our educational technology courses held in state-of-the-art university computer labs, and as we as instructors proselytized the power of technology for learning, they were concurrently placed in real classroom contexts in which they were confronted by their mentor teachers' varying perspectives of technology's usefulness.

Preservice teachers must see technology as logistically and managerially feasible if they are to use it in their classrooms, thus issues around classroom management and control, integrating the computer into the daily lessons, and "seeing in action" the use of computer technology are critical in the preparation of teachers (Keiper, Harwood, & Larson, 2000). However, are university teacher preparation courses painting too optimistic a picture of technology's role in the classroom? In their developing vision of using technology for teaching and learning, preservice teachers are being presented with two conflicting perspectives. Perhaps the mismatch in university context and school reality signals to teacher educators a need to infuse a dose of reality into the preparation of new teachers; novice teachers should be able to consider logically the use of technology in order to make sense of the two worlds on their own, rather than being thrown into the unexpected reality once they begin teaching. This cognitive dissonance in students' understanding (Mahlios, 2002) can result in an image of teaching that emerges where pedagogical ideals overlap like a collage (McDermott, 2002).

Teacher Education Students Driving the Development of a Technology-Rich Program

Many have testified that the use of students as mentors to faculty technology development successfully functions as a support scaffold (Heuer, 1997; Smith, 2000; Sprague, Kopfman, & Dorsey, 1998; Zachariades & Roberts, 1995). An emerging finding of this present study highlights a unique and less formalized way in which students may affect the advancement of technology-rich courses. It appears that there is a developing grassroots awareness and corresponding inclination to push for technology use.

When asked, our participants reported fairly regular, if limited, technology use by their other teacher preparation faculty. It was common for students to be required to word process papers, several instructors conducted lectures using electronic presentation, and classes increasingly took advantage of a College-adopted Web-based discussion forum. Following a university initiative to create Web-supported course materials, all participants had taken two or three required teacher education courses where WebCT was used as a support, including some combination of posted lecture notes, assignment submission, course calendar, and other information. Interestingly, even those less-experienced technology-using participants had adapted and were used to using this Web-based structure even by the first time they were interviewed for this study.

As prevalent as these technology uses were and as promising as they were for the integration of technologies into our program, the uses themselves remained merely supportive in nature. These were not examples that changed substantively the teacher and learner roles, nor did they require faculty to alter teaching styles, and participants had become aware enough of the importance of technology in their preparation that they now served as critics of the ways in which technology was used in their other teacher preparation courses. A common fault noted by respondents is that although professors did have expectations for student technology use to complete assignments, they did not see significant instructional use of technology in their coursework. Instructor expectations for student technology use coupled with lack of incorporation into their own teaching could mark a first step in the evolution of faculty technology proficiency.

One participant scorned the way her professor diminished the importance of technology as a required element in a project:

> One of four assignments had to include technology, and the instructor said if it involves technology, you don't have to bring it

in, you can just describe it . . . if you're using technology, you don't have to do it.

This student felt as though she were cheating by not having to demonstrate the technology components of the lesson. Her sense of technology as a fundamental part of teaching exacerbated its absence from the requirements. A second student summed up a criticism of instructors common among participants: "It seems like with professors outside technology, they use what's there. If there is an overhead, they'll incorporate that; if it wasn't there, they wouldn't."

Attending our first technology course and beginning to hear our philosophy of connecting technology use to other instruction, as well as, for these particular teacher education students, participating in such a reflective research project as this, heightened these students' awareness of the types of technology that should be a part of their own learning environments. Not only did they voice complaints and list omissions in some of their preparation experiences, but they indeed became instigators of change. Here, one student described her leadership role in pushing the use of technology to explore basic required teaching competencies and her instructor's resulting impression of the strategy:

> In the summer [course], I had to do presentations, and I did a PowerPoint . . . I attached an "edugame" [nonlinear presentation] at the end. I presented on each competency; I went to a book of . . . questions that applied to my competency. It kicked off the idea. We went and printed the review test and . . . then we decided, let's all take it! Dr. Edwards was so impressed. She asked, "Where did you get the clipart?"

Their confidence to use technology tools to accomplish educational goals was growing. One participant described her use of Internet searching to complete a course assignment: "Rather than have to sit in the library, I'll use the online library," and another concurs with:

> I probably didn't have to use the Internet, but it is easier-we had to find ten art sites for children in Houston. I went in and just typed "art centers in Houston" and I found a site with a list of all of the museums . . . . When a professor assigns a project, I go to the computer almost immediately to look up what I need to.

What these future teachers revealed was a natural and quite ingrained reliance on technology for productivity and information-seeking activities. So, how can teacher preparation faculty capitalize on this knowledge of growing student technology abilities? Students pushing the boundaries of the vision of technology use in their coursework could conceivably result in a range of scenarios. At the low end, the result could be no change at all, with faculty reluctantly permitting the use of technology as a presentation or production device. Instructors may think they "need" to allow convenient uses of technology because of the increasing societal pressures, and in fact, they may see this as a painless way to appear to be integrating technology into their courses. At a next level, faculty could permit students to use technology and then find themselves genuinely captivated by student integration efforts, perhaps opening their minds to the possibilities and initiating information-seeking dialogue between faculty and students. At the most optimistic end of the spectrum, faculty could be so intrigued that they act to change syllabi to include meaningful uses of technology. We accept the challenge of working toward all of these scenarios and hope to continue to explore with our participants their roles in this change process.

Perhaps the natural willingness of these students to actively drive the change process demands that we openly recognize the role of student agency in large-scale change of teacher education programs. Students could provide the link between the technology tools and strategies and other teacher preparation courses, either as a supplement to the mentoring process and other faculty development initiatives or as a catalyst when such efforts prove ineffective. These early results in a longitudinal study should not be misunderstood to imply that we can rest and let change happen organically. Instead, these initial findings signal an opportunity to examine the teacher preparation coursework in our own institutions and more actively assist students in brainstorming appropriate technology integration strategies. In essence, students can be empowered to push the meaningful use of technology program-wide.

The instances that students have mentioned largely involve productivity tools and have been used to produce an assignment that looks similar to what the assignment might have looked like without technology, such as digitizing presentation slides or including Web resources when only print-based resources were requested by the instructor. This initiative on the part of students is promising and bodes well for upward development of technology proficiency and modeling that could affect faculty. However, a powerful use of technology may be overlooked if this becomes relied on as a primary strategy for infusing technology into teacher education courses. Those technology tools that are most beneficial to certain content areas (e.g., math probes for math education, digital microscopes for science education) may never be introduced if it is left entirely to the students to drive technology use. Students may be unaware of these items, and it may not occur to them to seek them out. Thus, teacher education faculty, with expertise in content and teacher preparation pedagogy, must be encouraged to enrich their particular instruction with specific, higher-end technology tools to ensure the best quality product in terms of its content (Roberts & Hsu, 2000).

Conclusion

These initial findings provide support to others who have suggested that teachers must have diverse experiences in order to enter the classroom with a comprehensive ability and an associated positive belief system necessary to use technology (Russell et al., 2003). Longitudinal case study research such as this could uncover layers of the developing teaching identity and the place of technology use in the vision of teaching.

We believe we are structuring a forum through which these particular novice teachers can tell their own story and come to connections, both individually and jointly, that not only will help shed light on becoming a teacher in the age of technology but will ultimately form the basis for improved self-reflection, and in turn, technology-rich teaching practices. Their emerging identities as technology-using teachers will continue to mature, and whether their current visions of technology-rich teaching will become reality remains to be seen and will be the focus of future writing from this project.

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Melissa Pierson is an assistant professor in the Instructional Technology Program at the University of Houston. She teaches undergraduate and graduate instructional technology courses, and co-directed a PT3 grant project that restructured UH's preservice technology courses and involved faculty in individualized technology instruction, co-authored the book Using Technology in the Classroom (2004), and is president of ISTE's SIGTE.

Melissa E. Pierson
University of Houston
256 Farish Hall
Houston TX 77204-5027
Phone: 713.743.4961
mpierson@uh.edu

Alysa Cozart is a doctoral student in Instructional Technology and a former classroom teacher of middle grade students.

Alysa Cozart
University of Houston
256 Farish Hall
Houston, TX 77204-5027
Phone: 713.743.5205
acozart@pioneer.coe.uh.edu